instruction manual

MODELS
FC 1000 & FCD 1000
FREQUENCY CHANGERS

Sorensen

Sorensen & Company, inc.
Richards Avenue
South Norwalk, Conn.

MP MASTER
MA25454

GENERAL INFORMATION

PLEASE READ THIS MANUAL. We think it will help you to obtain the maximum performance from your new Sorensen instrument.

SHIPPING DAMAGE

Sometimes instruments are damaged in transit. We strongly suggest that you inspect and test your instrument as soon as you receive it. If the instrument is damaged or if it fails to operate properly, you should ask the carrier to inspect the shipment. The carrier's claim agent will prepare a report of damage which you should send to us. We will then tell you how to have the instrument repaired or replaced.

SERVICE INFORMATION

If you have any questions about the operation, repair, or servicing of a Sorensen instrument, please contact our local representatives. (A list of representatives appears at the rear of this manual.) If it is more convenient you may contact us directly at the Service Department, Sorensen & Co., Inc., Richards Avenue, South Norwalk, Connecticut.

IMPORTANT

BE SURE TO INCLUDE THE MODEL & SERIAL NUMBER IN ALL CORRESPONDENCE CONCERNING THIS INSTRUMENT. WITHOUT THIS INFORMATION WE MAY NOT BE ABLE TO GIVE YOU PROMPT AND ACCURATE SERVICE.

RETURNS TO THE FACTORY

Should you decide to return an instrument to us for repair, please contact us for authorization to make shipment. We have a number of local service facilities in the United States and Canada which are equipped and staffed to provide you with fast, efficient service. For this reason, we reserve the right to refuse unauthorized shipments to our plant.

WARRANTY

This instrument is warranted by Sorensen & Company, Inc., to be free from defects in material and workmanship. Our obligation under the warranty is limited to servicing the instrument and replacing defective parts when the instrument is returned to the factory with transportation charges prepaid. No other warranties may be implied. The period of warranty is one year after the delivery of the instrument to the original purchaser. Defects caused by improper operating conditions, accidents, misuse, negligence, and the alteration or removal of the nameplate, will void the warranty.

MODELS

FC1000 & FCD1000

Frequency Changers

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NOTES

II. SPECIFICATIONS

The Models FC1000 and FCD1000 are Frequency Converters offering both voltage and frequency regulation. They offer many outstanding features which make them ideal for both laboratory and industrial applications.

Specifications

Input Voltage

Standard: 208 ± 10% or 230 ± 10%, 50-60 cycles, Single Phase (taps are provided on the input transformer for either 208 volt or 230 volt operation).

Special: A modified model powered from a 115 volt nominal source is available on customer request.

Output Voltage

Adjustable 105 to 125 VAC

Load Range

0-1000VA

Output Frequency

Model FC1000

Standard: Low Range - 45 to 55 cps.
High Range - 55 to 65 cps.

Special: ± .010% fixed (60 cps.) Installed in unit only on request. Sorensen Part No. SD190-1044

Model FCD1000

Standard: 360-440 cps.

Special: ± .010% fixed (400cps). Installed in unit only on request. Sorensen Part No. SD194-345

Regulation Accuracy

Voltage: The regulation of the output voltage is ± 1% for all conditions stated in the specifications.

Frequency: The frequency regulation is ± 1% for all conditions stated in the specifications.

Recovery Time

0.5 Second

Drift:

Voltage: Less than 1 volt over a 24 hour period after initial warmup.

Frequency: $\pm$ 1% over a 24 hour period.

Ambient Temperature Range

0°C (32°F) to 35°C (95°F)

Load Power Factor

Unity to 0.5 lagging

Size

17" wide, 28" high, 15" deep

Weight:

Model FC1000 285 lbs.
Model FCD1000 235 lbs.

SPECIFICATION NOTES

Recovery Time

When an abrupt change occurs in the input voltage or output load, an instantaneous change in output voltage occurs. This instantaneous change is quickly suppressed by the regulating action of the instrument. Recovery time is a measure of how fast this change is suppressed. It is defined as the time necessary for the output voltage to affect a 63% recovery from the maximum deviated value, based upon a 10% line voltage change, or a 50% step change in the load.

Time Delay

A time delay relay is used to permit filament warm-up, hence no output power is available until 60 seconds after the input switch has been placed in the standby position.

Regulation Accuracy

The regulation accuracy is $\pm$ 1% for input line changes (208 $\pm$ 10% or 230 $\pm$ 10%) and any load change from zero to full rated load.

Input frequency, load power factor and ambient temperature will affect the regulation accuracy. The above specifications for regulation accuracy are only guaranteed at the specified ambient temperature, frequency and power factor.

Safety Circuits

A. Overvoltage safety circuit - Overvoltage circuit breakers turn off the output voltage in the event the output voltage rises above 135VAC.

B. Overcurrent safety circuit - A relay is provided that senses the output current and pulls in if the current is too high. The relay will continually sense this current and "clatter" if malfunctioning or overload continues.

C. Fuses: F3 protects the oscillator circuit.
Fuses F1 and F2 protect the input transformer.

Meters

A. Voltmeter- 0-150VAC, accuracy $\pm$ 2% of full scale.

B. Ammeter - 0-15 amps, accuracy $\pm$ 2% of full scale.

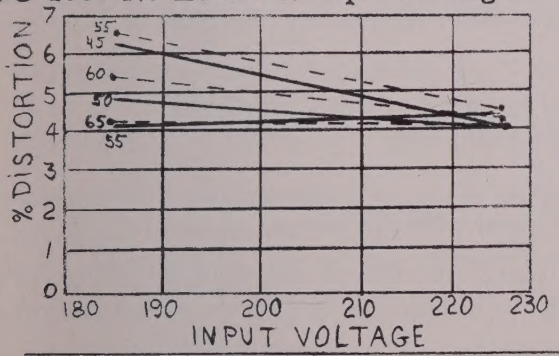
C. Frequency Meter - FC1000 - 45-65 cps. 0.3% accuracy in 1 cps. steps.
FCD1000-360-440 cps. 0.3% accuracy in 8 cps. steps.

Unless otherwise requested, frequency meter and voltmeter are standard equipment on instruments without precision frequency source. Voltmeter and Ammeter are standard on instruments with precision frequency source.

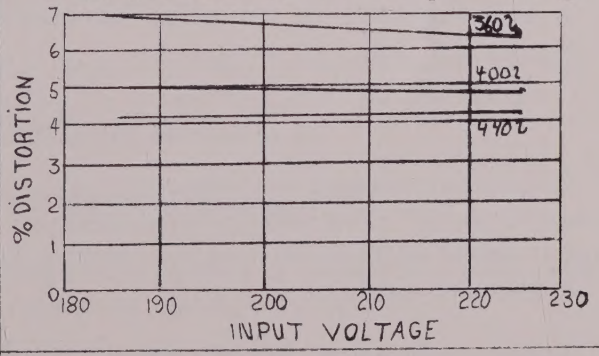
Output Distortion

Curves relating distortion to line, load and output frequency are shown below.

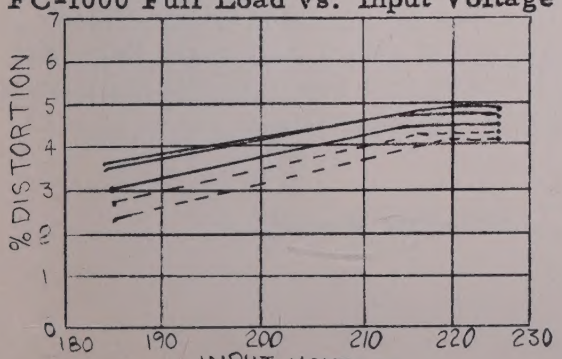
FC-1000 No Load vs. Input Voltage



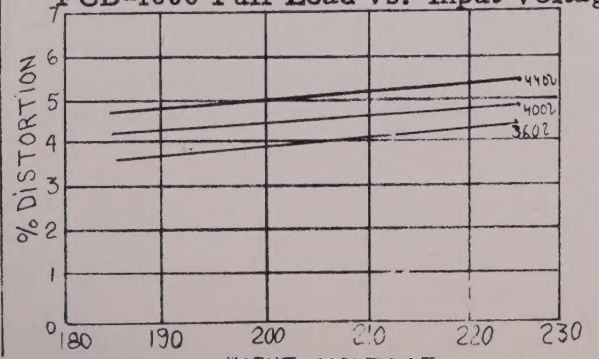
FCD-1000 No Load vs. Input Voltage



FC-1000 Full Load vs. Input Voltage



FCD-1000 Full Load vs. Input Voltage



——— Low Range
- - - - - High Range

Radio Noise

Some Radio Frequency noise is generated by these instruments, and may affect sensitive types of communication equipment. We recommend that these instruments be operated at least 15 feet from any such equipment.

Optional RF noise suppressing kits can be provided for filtering the input and output.

These suppression kits may be installed at the factory or at the customer location. Four filters are required, two at the input and two at the output.

FC 1000	Input Filter	SD 190-1147
	Output Filter	SC 190-1135
FCD 1000	Input Filter	SD 190-1081
	Output Filter	

Audio Noise

The audio noise level of these instruments is comparable to the noise level of a quiet office. This is approximately 65 db. at a distance of six feet.

Fixed Output Frequency

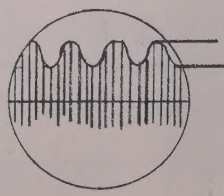
A fixed output frequency having a regulation accuracy of .01% is optional. The fixed frequency driver is normally installed at the factory, however, it may also be installed in the field by following the instructions given in Section III "Installation and Operation".

When using the fixed output frequency, the source installed variable frequency is still available by use of an internal switch located on the oscillator terminal board.

Output Voltage Modulation

The output voltage modulation is specified as being 2% maximum. This figure assumes no input voltage modulation. If input voltage modulation is present, the output voltage modulation will be directly affected by it. (Increased proportionally).

Output modulation may be also referred to as "envelope modulation" and is caused by the commutating action of the inverter (Thyratron) tubes. This modulation is the amplitude variation measured at either half cycle from the minimum peak to maximum peak value. The diagram below shows the portion of the waveform that is considered as envelope modulation.



Envelope Modulation

III. INSTALLATION AND OPERATION

Input Power

Lines for input power should be run through the bushing in the rear of the bottom plate. The input power leads are connected to the screw lugs on the fuse cutout. #14AWG is the recommended wire size for input power. A ground connection is provided on the fuse cutout bracket and should be used in the installation.

Unless otherwise specified, the input is wired for 230 volt input. For 208 volt operation the input wires on terminals #8 and #2 of the input transformer (T1) must be moved to terminals #7 and #3. See photograph at rear of manual for location of T1.

Output Power

The output is available at the two binding posts located on the front panel, and isolated, thus it can be grounded, if so desired.

Installing Tubes Packed Separately

In order to prevent damage in shipment the rectifier and inverter tubes (V1-V4) have been removed from their sockets and shipped under separate cover. It will be necessary to unpackage the tubes and replace them in their sockets. Each tube can be placed in either of two sockets according to tube type which is clearly marked on the chassis. A plate lead must be attached to each tube.

External Disconnect Switch

The customer should provide an external input line disconnect switch for the units in as much as plate voltage is applied to tubes V1 and V2 at all times. This is important in the event these tubes must be changed.

Installing the Fixed Frequency Driver

Should it be desired to add the Fixed Frequency Driver in order to obtain .01%, regulation accuracy installation of the driver is made as follows:

A. Mount driver in space provided on the bottom of the front door assembly.
B. Wire the inter-connecting cable from the Oscillator Chassis Assembly Driver Terminal #1 to Oscillator Terminal #7, #2 to #8, #3 to #9, etc.
C. To place driver in operation, place switch "SW2" on the oscillator terminal board to position marked "Driver".

Operating Instructions

Note: Before commencing operation check to see that the oscillator switch SW2 (on oscillator terminal board) is in the correct position. The "Oscillator" position is used for variable Frequency Applications. The "Driver" position for operating the fixed frequency standard.

To commence operation, turn input power switch to the correct position. Turn the circuit breaker located on the front panel to the "On" or "Up" position.

On the Model FC1000 the input power switch is a five position rotary switch. Position one is "off". Position two is "standby", turning filament power on. Position three turns unit on with 45-55 cycle output. Positions four and five are standby positions. Position six turns unit on with 55-65 cycle output.

CAUTION: Do not attempt rapid switching between frequency ranges as this will limit life of switch. Allow at least a five second delay between positions when switching ranges.

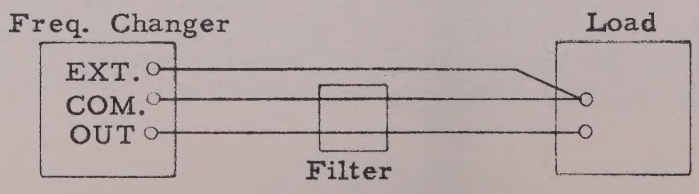
On the Model FCD1000 the input power switch is a three position switch. When this switch is in the "down" position no power is applied to the unit. When the switch is in the "center" position power is applied to all circuits with the exception of the output which remains off. Placing the switch in the "up" position turns on the output power.

Note: On the model FC1000, when using the precision oscillator (driver) the frequency adjust knob on the front panel should be in the "Driver Set" position.

Remote Sensing

It is possible to remotely sense the output load without affecting the regulation accuracy of the instrument.

If additional filtering or remote sensing is used, remove the link that connects the "Ext." terminal and the "Com. Terminal" and connect the output load as shown in the diagram below.

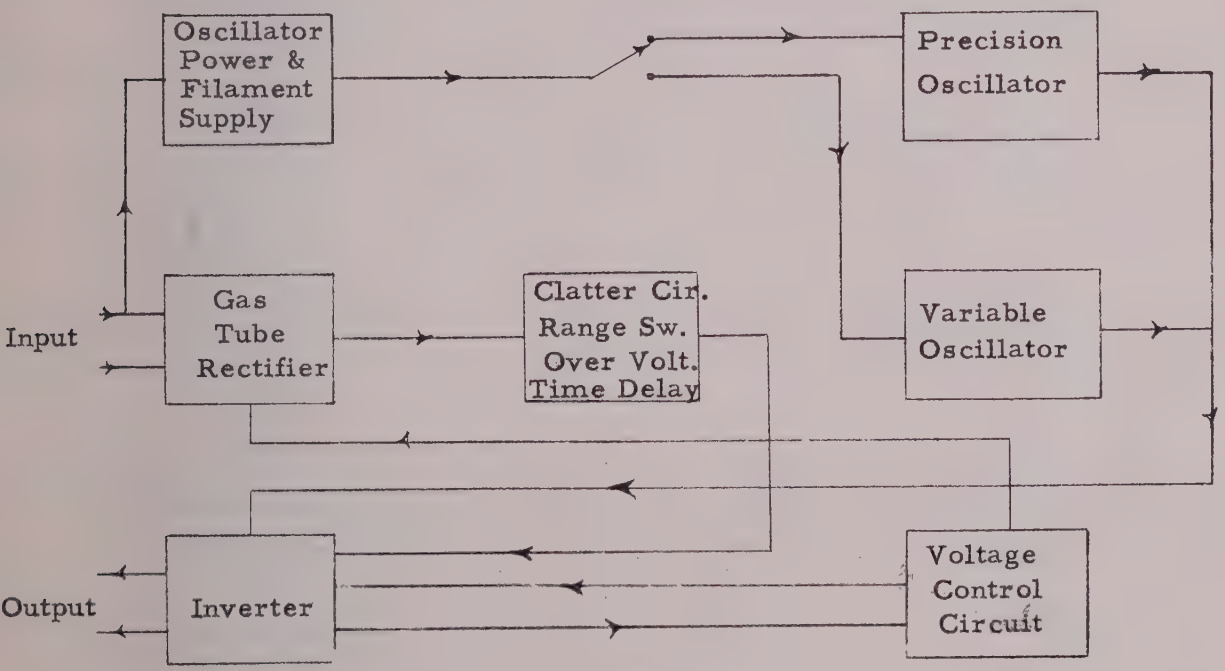


IV. PRINCIPLE OF OPERATION

General Description

Both the FC-1000 and FCD-1000 are inverter type frequency changers employing thyratrons in both the rectifier and inverter circuits. Voltage regulation is obtained by shunt control of the output and also by an electronic servo loop and grid control of the rectifiers. The output frequency is controlled by either a Wein Bridge Oscillator (FC-1000) or a Phase shift oscillator(FCD-1000.) For more accurate control a tuning fork may be used in either model.

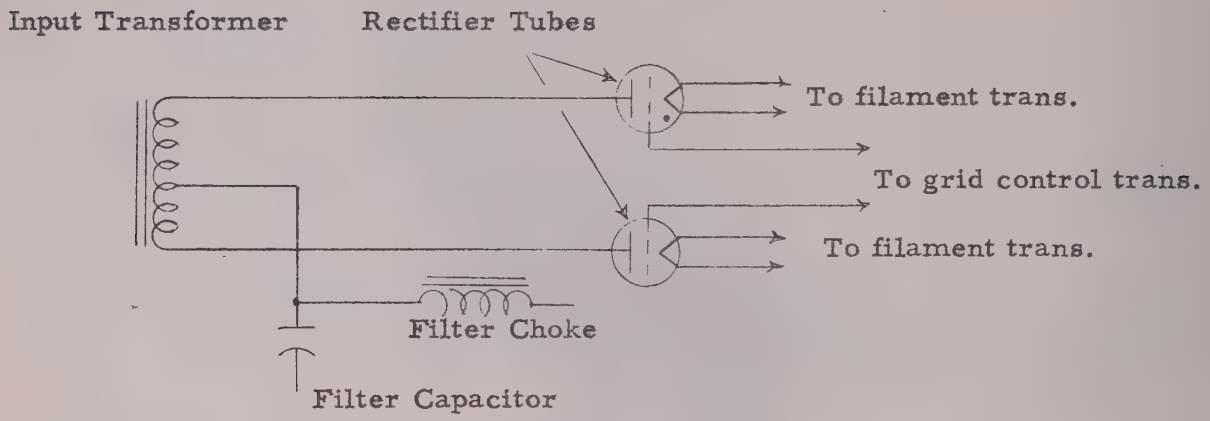
The frequency changer may be divided into four main sections with auxiliary equipment. This can best be understood by referring to the block diagram and description of each section shown below.



Rectifier Section

This section consists of an input transformer, thyratron tubes V1 and V2, filter choke and filter capacitors. This section rectifies the input to provide DC power for the Inverter Section. It also forms part of the voltage regulating circuit as will be described later.

Fig. 2 "Typical Rectifier Section"



Inverter Section

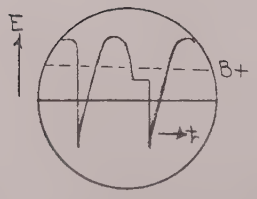
This section consists of an output transformer, commutating choke, commutating capacitors and tubes V3 and V4.

When DC voltage is applied the tube with positive grid tends to fire. This builds up a voltage across the output transformer dependent on the components of the R (load resistance), L (commutating choke) and C (commutating capacitors) circuit seen by the DC supply through the conducting tube. This voltage builds up until the grid of the other tube becomes more positive than its critical grid voltage. This tube then fires placing a negative voltage on the plate of the first tube cutting it off and then completing the cycle across the output transformer. This process is continuous at the frequency of the grid drive supply giving stable output frequency.

An oscillogram of the voltage across each Inverter tube of the output transformer is shown in fig. 3A and 3B. A combination of these two is produced across the secondary whose frequency is identical to that of the grid supply frequency.

Fig. 3

3A



3B

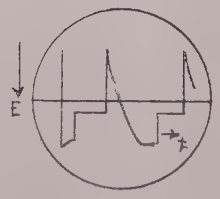
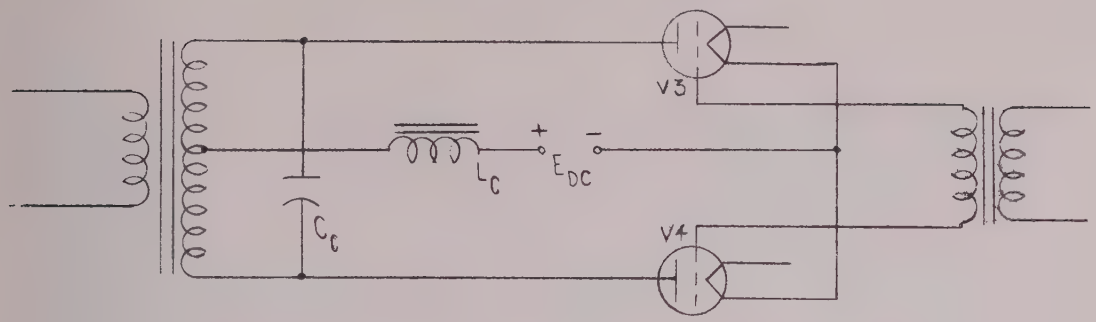


Fig. 4 "Typical Inverter Section"



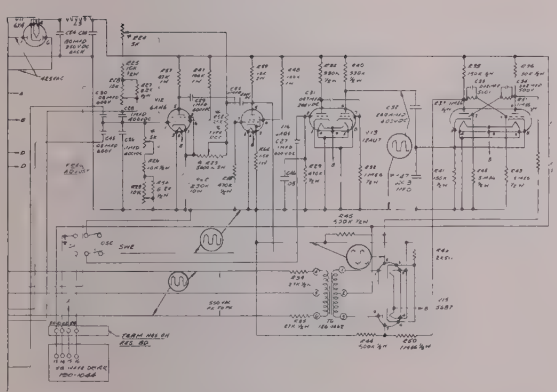
Oscillator Section

The best method of obtaining drive suitable for inverters is through the use of a "flip flop" stage. This type of circuit qualifies in that it produces a sharp symmetrical waveform and of such an amplitude that only one stage of amplification is required. The oscillator used in the model FC1000 is a standard Wein Bridge type using a lamp bulb for negative feedback. A phase shift oscillator is used in the Model FCD-1000.

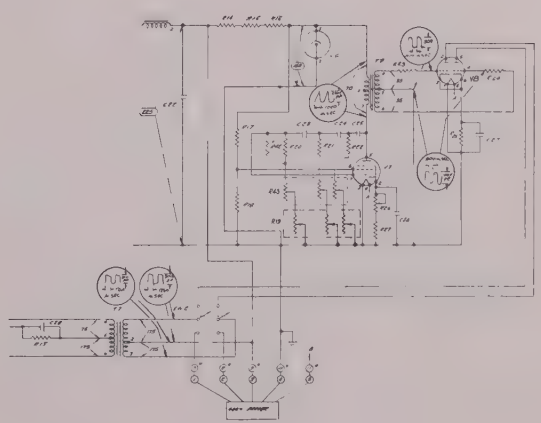
On both the FCD1000 and FC1000 a tuning fork oscillator may be used as the frequency determining element for more accurate output frequency applications.

Fig. 5 "Typical Oscillator Section"

FC-1000



FCD-1000

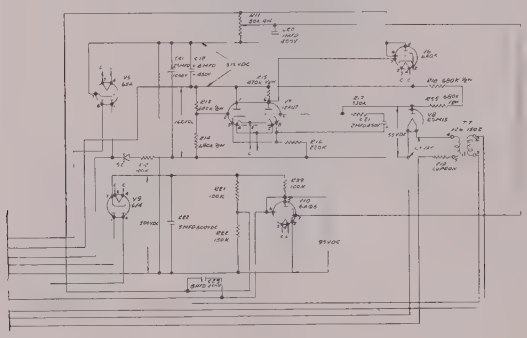


Voltage Regulator Section

The operation of this section can best be understood by referring to the schematic diagram shown below.

A typical sequence of operation in the Voltage Regulator section would be as follows. When the output voltage tries to rise the diode filament voltage increases lowering its resistance. This forces the grid of the right hand side of V11 more negative raising the voltage at its plate and raising the grid of V10. This increases the current through the DC coil of the Saturable Core Reactor attempting to lower the output voltage. The grid of V13 also becomes more negative forcing the grid voltages of V1 and V2 more negative. These tubes then fire for a smaller portion of the cycle lowering the main DC voltage and also the output voltage.

Fig. 6 "Typical Voltage Regulator Section"



Auxiliary Circuits

1. A 250 volt power supply with power transformer, DC choke and related capacitors. This supplies power for the oscillator or driver.

2. A negative bias supply. This consists of rectifier S1, related capacitors and resistors and the bias winding on the input transformer. This applies negative voltage to grids of V1 and V2 when either switch SW1, relays K1, K2 or K3 are open holding off the rectifier section. K1 is the time delay relay which provides a 60 second warm up for the tube filaments. K3 is an over current relay which opens the rectifier section when the inverter misfires.

3. Overvoltage circuit consisting of rectifier S2, resistor R6, capacitor C21 and relay K2, on the FCD1000, resistor R6 and relay K3 on the FC1000. This circuit shuts off the output voltage when the output is above 135 VAC.

V. MAINTENANCE AND REPAIR

Maintenance

During normal life these instruments require no maintenance or servicing other than the care usually afforded this type of equipment. Tubes should be replaced at the end of their specified life in accordance with the policies established for the particular application.

The fan motor should be oiled every 750-1000 hours. Use good quality oil # S. A. E. 20. Place about 10 to 15 drops in each bearing.

Spare Parts

All components used in these frequency changers are of a good commercial grade and can be expected to give a reasonably long period of trouble-free service. As the age of your frequency changer increases, however, some components are likely to deteriorate; therefore, we suggest that you consult the recommended spares noted on the Replacement Parts list for those parts that should be kept on hand. In the event it becomes necessary to replace any part, we strongly urge that the replacement be of the same value as the original. Substitute parts should not be used unless we advise you that the substitute value will not impair the performance of your instrument.

Repair

In the event of malfunctioning of the frequency changer due to deterioration or failure of any of its component parts a systematic checking procedure will provide the quickest and surest method of locating the difficulty.

The following section gives systematic checking procedures which should be followed in locating sources of trouble.

Typical circuit voltages and waveforms are indicated on the schematic drawings supplied in this instruction manual. All voltage measurements should be taken with a 20,000 ohm/voltmeter.

All components and sub-assemblies are readily accessible should it be found necessary to make repairs. The Oscillator assembly and the Controller assembly can be removed from the units to afford more convenient trouble shooting and repair of these sections.

CAUTION: FOR SAFETY REASONS, DISCONNECT THE INPUT LINE BEFORE ATTEMPTING ANY INTERNAL REPAIR.

Trouble Shooting Chart

Symptom	Circuit to Check	Possible Causes and Procedures
High Output Voltage	Controller	A. Check the voltage at the DC coil of the Saturable Core Reactor (Indicated on schematic). If there are improper voltages or no voltage at this point, check the control circuit components. B. Check controller supply voltages by checking the plate voltages and replacing the 6X4. C. Replace the 6AQ5, if this has no affect check for high grid bias on the 6AQ5. (typical grid bias voltage is -45VDC) D. If the grid bias on the 6AQ5 is high, replace the 12AU7. High grid bias on the 6AQ5 can be caused by excessive plate current or low grid bias on the 12AU7 (typical grid bias voltage for the 12AU7 is 1.0VDC). E. If the grid bias on the 12AU7 is low, check the 2SM15. Check the filament voltage on the 2SM15 (1.8 $\pm$ 0.2 volts if this is low, check the Filament Transformer for open or shorted turns. F. If the tubes and voltages are normal check resistor and capacitor values throughout the entire control circuit.
Low Output	Control Circuit	A. Replace the 2SM15 Diode Tube. B. Replace the 6AQ5. C. Check DC Voltages across the DC coil of the Saturable Core Reactor. D. Check grid bias and plate voltages throughout the control circuit. E. Check DC voltages at the output filter capacitor (typical voltage 150 volts). F. Check voltage across the grid control capacitor. Typical voltage across grid control capacitor is 170 volts.

Symptom	Circuit to Check	Possible Causes and Procedures
High Modulation	Oscillator Section	A. Replace tubes in oscillator section. B. Check the voltages across the Audio Transformer, making sure that they are balanced. C. Check for grid balance on the 6BL7. Check cathode to grid. D. Check the plate and screen voltages on the 6AQ5. E. Check resistance and capacitance value throughout the oscillator section, particularly R26, R27 and C26. F. Check the NL760 Tubes (V3 and V4). G. Check the supply voltage across the 0A2 Tube. H. Check the ripple voltage across the output filter capacitors. This should not exceed 1%. I. When using a fixed frequency driver check the tuning fork.
High Distortion NOTE: Because of the frequency changers reliance upon fixed values of reactive elements, the curve of distortion vs. output indicates a null at the center of each range. Thus, at the extremeties of each range, the distortion may rise as high as 6 or 7%. Distortion at the center of the range will be 4-5% under nominal conditions.		A. Readjust the Grid control potentiometer located on the controller sub-assembly. This potentiometer should be adjusted as follows: Adjust it so that the DC voltages across C8 reads 150 VDC. CAUTION: Adjustment of this potentiometer reaches a null point under 150 VDC. Therefore, 150 VDC can be reached on either side of the null.

Symptom	Circuit to Check	Possible Causes and Procedures
Clattering NOTE: The "clatter relay" may actuate in the FCD-1000 when the unit is first turned on. This is caused by the Inverter failing to invert instantly, with a resultant high current being drawn.		A. Check DC voltage across the Filter Capacitor. This should be approximately 250 VDC. B. Check driver voltage from grids of V3 and V4 to their filaments. This should read about 100 volts RMS. C. The unit will clatter when the output is shorted or when the load is substantially higher than rated. The unit may clatter when the load consists of elements which present low impedances before the warm up. D. The unit will clatter if the commutating capacitors are defective. E. A burned out diode or other control circuit trouble may cause clattering.
No Output		A. Check input fuses F1 and F2. B. If the controller section tubes do not light check fuse F3. C. Check time delay relay. D. Check clatter relay. E. Check switch SW1.
Poor Regulation	Controller	A. Check the distortion and mod-modulation to see that they are within the instruments specifications. B. Check the 6AQ5. If this tube is weak it will cause the output to slowly drop when load is applied. C. Check the remaining tubes in the control section. D. Check the voltage at the output capacitors and across the output bleeder resistor. At the time you check this voltage, check to see that the DC supply ripple is approximately 1. 0%.

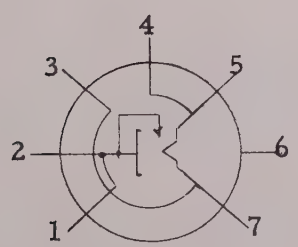
Symptom	Circuit to Check	Possible Causes and Procedures
		E. Check the ELC6J tubes (V1 and V2) and the NL760 tubes (V3 and V4.) F. Check the Phase Shift network. If the Phase Shift resistor is defective or is not adjusted properly, the DC voltage across the output filter capacitors will be low. If the Phase Shift capacitor is shorted or defective it will affect this voltage in the same manner. G. Check the grid control capacitor. H. Check the component values through-out the entire control circuit.

Note: If the instrument starts without throwing SW1 to the "on" position, check the voltage across the Phase Shift Capacitor. This should read approximately **300 VDC.**

2SM15 Tube Data

In almost all cases it will be found that the 2SM15 tube is good if the filament is intact; however, for those customers who wish to set up special test the following data is included:

Filament	1.8 volts DC/AC 310-335 MA
Plate	500 volts DC .410-.550 MA DC



Replacement Parts List

FC1000

Listed below are all the components used in this instrument, together with their functions and part numbers.

Reference to the schematic diagram furnished with this manual will give the position of each component in the circuitry.

Schematic Symbol	Description	Function	Sorensen Part No.	Specifications
R1	Resistor 10K ohm 2W	Phase Shift Resistor	27-305	Allen Bradley HB1031
R2	Resistor 100K ohm 2W	Limiting Resistor	27-328	Allen Bradley HB1041
R3	Resistor 330K ohm 1W	Grid Limiting Resistor	27-284	Allen Bradley GB3341
R4	Resistor 330K ohm 1W	Grid Limiting Resistor	27-284	Allen Bradley GB3341
R5	Resistor 500 ohm 25W	Bleeder Resistor	27-720	Ward Leonard 25F
R6	Resistor 500 ohm 25W Adj.	Overvoltage Resistor	27-748	Ward Leonard 25A
R7-10	Resistor 250 ohm 100W	Output Bleeder Resistor	27-831	Ward Leonard 100F
R11	Potentiometer 50K ohm 4W	Grid Control Potentiometer	29-213	Mallory M50MP
R12	Resistor 100K ohm 1W	Limiting Resistor	27-232	Allen Bradley GB1041
R13	Resistor 680K ohm 1/2W	Voltage Divider Resistor	27-950	I. R. C. type DCC
R14	Resistor 680K ohm 1/2W	Voltage Divider Resistor	27-950	I. R. C. type DCC
R15	Resistor 470K ohm 1/2W	Plate Resistor	27-146	Allen Bradley EB4741
R16	Resistor 220K ohm 1W	Cathode Resistor	27-240	Allen Bradley GB2241
R17	Resistor 330K ohm 1W	Grid Resistor	27-284	Allen Bradley GB3341
R18	Resistor 680K ohm 1/2W	Plate Resistor	27-950	I. R. C. type DCC
R19	Resistor 2.3 ohms/ft.	Range Adjusting Resistor	21-029	C. O. Jelliff
R20*	Potentiometer 3 ohm 3W	Voltage Adjusting Resistor	29-032	Clarostat CM10120
R21	Resistor 100K ohm 1W	Bridge Resistor	27-232	Allen Bradley GB1041
R22	Resistor 150K ohm 1W	Bridge Resistor	27-236	Allen Bradley 1541
R23	Potentiometer 5000 ohm 3W	Feedback Potentiometer	29-219	Clarostat CM Hi-Torque
R24	Potentiometer 5000 ohm	Calibration Potentiometer	29-089	Chicago Tel. type 2-35
R25	Resistor 10K ohm 1/2W	Tuning Resistor	27-984	I. R. C. type DCC
R26	Resistor 10K ohm 1/2W	Tuning Resistor	27-984	I. R. C. type DCC
R27	Resistor 8.2K ohm 1/2W	Calibration Resistor	27-155	Allen Bradley EB8225
R28*	Potentiometer 10K ohm 3 Sec.	Frequency Adj. Pot.	29-095	Chicago Tel. Co. type 3-35
R29	Resistor 470K ohm 1/2W	Grid Leak Resistor	27-146	Allen Bradley EB4741

Replacement Parts List

FC1000

Schematic Symbol	Description	Function	Sorensen Part No.	Specifications
R30	Resistor 330K ohm 1/2W	Plate Resistor	27-148	Allen Bradley EB3341
R31	Resistor 1K ohm 1/2W	Plate Resistor	27-103	Allen Bradley EB1021
R32	Resistor 1 meg ohm 1/2W	Grid Leak Resistor	27-124	Allen Bradley EB1051
R33	Resistor 150K ohm 1/2W	Plate Resistor	28-525	I. R. C. type DCC 1%
R34	Resistor 27K ohm 1/2W	Grid Limiting	27-110	Allen Bradley EB2731
R35	Resistor 27K ohm 1/2W	Grid Limiting	27-110	Allen Bradley EB2731
R36	Resistor 150K ohm 1/2W	Plate Resistor	28-525	I. R. C. type DCC 1%
R37	Resistor 1 meg ohm 1/2W	Divider Resistor	27-954	I. R. C. type DCC
R38	Resistor 330K ohm 1W	Load Resistor	27-284	Allen Bradley GB3341
R39	Resistor 100K ohm 1W	Plate Resistor	27-232	Allen Bradley GB1041
R40	Resistor 330K ohm 1/2W	Plate Resistor	27-148	Allen Bradley EB3341
R41	Resistor 150K ohm 1/2W	Cathode Resistor	27-119	Allen Bradley EB1541
R42	Resistor . 5 meg ohm 1/2W	Grid Leak Resistor	27-955	I. R. C. type DCC
R43	Resistor . 5 meg. ohm 1/2W	Grid Leak Resistor	27-955	I. R. C. type DCC
R44	Resistor 500K ohm 1/2W	Grid Leak Resistor	27-955	I. R. C. type DCC 1%
R45	Resistor 500K ohm 1/2W	Grid Leak Resistor	27-955	I. R. C. type DCC 1%
R46	Resistor 2K ohm 5W	Cathode Resistor	27-420	Ward Leonard 5F 2000
R47	Resistor 100K ohm 1W	Screen Resistor	27-232	Allen Bradley GB1041
R48	Resistor 100K ohm 1W	Screen Resistor	27-232	Allen Bradley GB1041
R49	Resistor 1 meg. ohm 1/2W	Grid Limiting	27-954	I. R. C. type DCC 1%
R50	Resistor 1 meg. ohm 1/2W	Grid Limiting	27-954	I. R. C. type DCC 1%
R51	Resistor 1 meg. ohm 1/2W	Divider Resistor	27-954	I. R. C. type DCC
R52	Resistor 3. 5K ohm 1/2W	Feedback Resistor	27-987	I. R. C. type DCC
R55	Resistor 680K ohm 1/2W	Plate Resistor	27-950	I. R. C. type DCC
R56	Resistor 8. 2K ohm 1/2W	Calibration Resistor	27-155	Allen Bradley EB8225
R57	Resistor 47K ohm 1W	Plate Resistor	27-223	Allen Bradley GB4731
R58	Resistor 470K ohm 1/2W	Grid Leak Resistor	27-146	Allen Bradley EB4741
R59	Resistor 15K ohm 2W	Plate Resistor	27-339	Allen Bradley HB1531
R60	Resistor 1. 5K ohm 1W	Cathode Resistor	27-295	Allen Bradley GB1521
R61	Resistor 1. 5 meg. ohm 1W	Time Delay Resistor	27-289	Allen Bradley GB1551
C1-C8*	Capacitor 300 mfd. 450VDC	Filter Capacitor	24-427	C. D. FW10007
C9	Capacitor 0. 5 mfd. 600VDC	Time Delay Capacitor	24-137	C. D. PJ6P5
C10	Capacitor o. 001 mfd 500VDC	Grid Capacitor	24-810	Jan-C-5 CM30C102K

Replacement Parts List

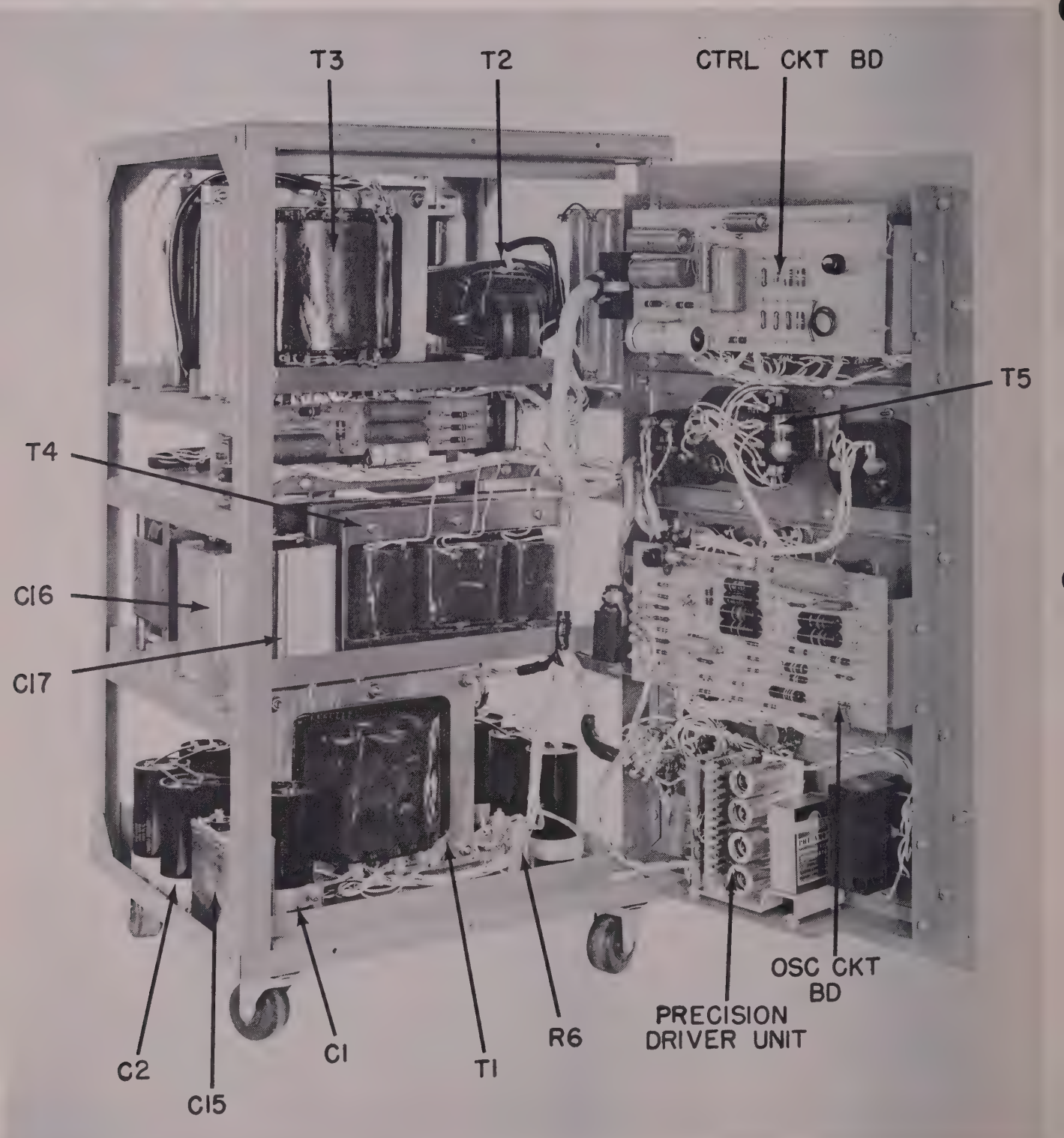
FC1000

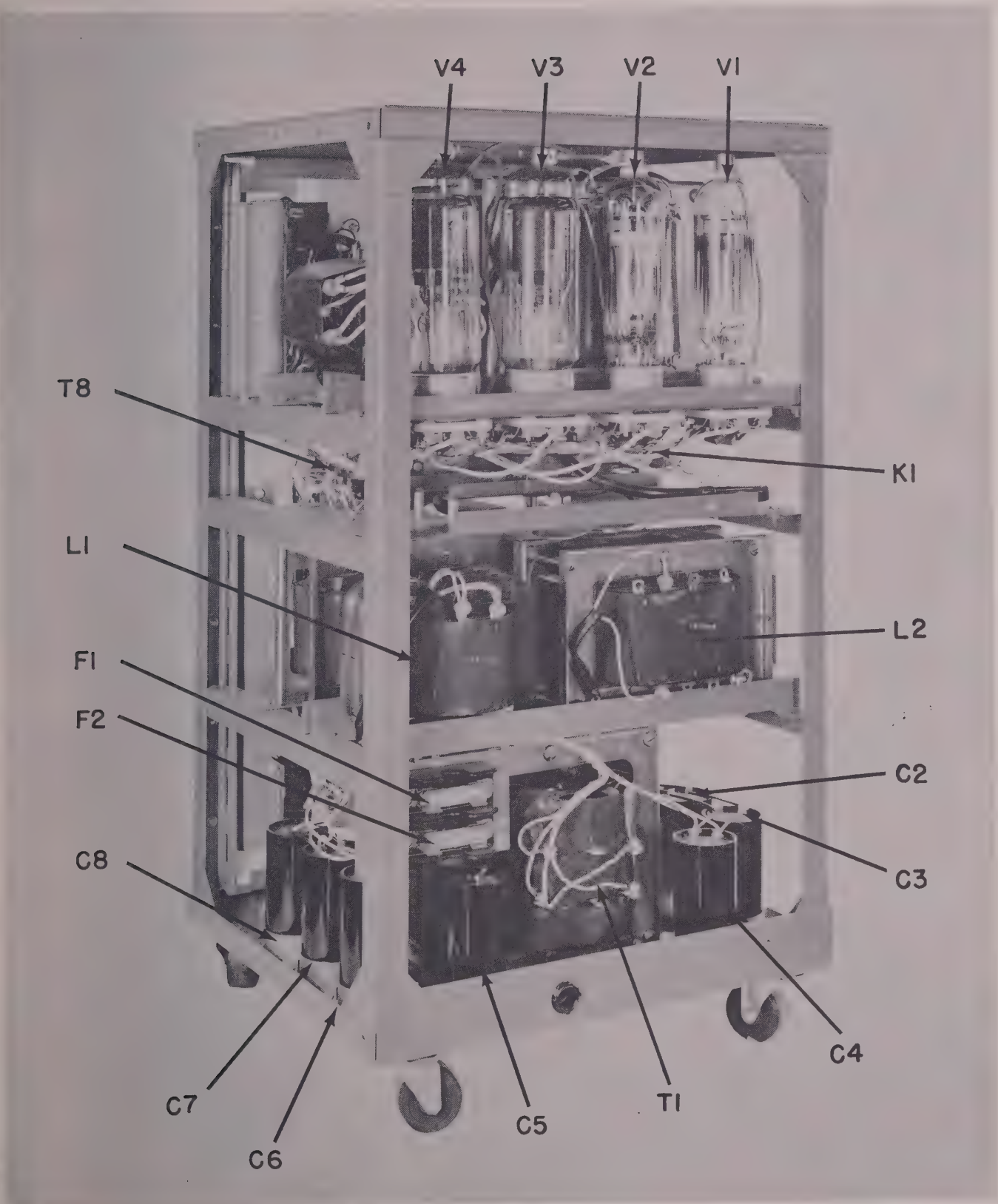
Schematic Symbol	Description	Function	Sorensen Part No.	Specifications
C12	Capacitor 0.001 mfd. 500VDC	Grid Capacitor	24-810	Jan - C-5 CM30C102K
C13	Capacitor 0.001 mfd. 500VDC	Grid Capacitor	24-810	Jan - C-5 CM30C102K
C14	Capacitor 0.001 mfd. 500VDC	Grid Capacitor	24-810	Jan - C-5 CM30C102K
C15	Capacitor 4 mfd. 660 VAC	Commutating Capacitor	24-315	C. D. KGT6040
C16	Capacitor 7 mfd. 660 VAC	Commutating Capacitor	24-379	C. D. KG 6070
C17	Capacitor 7 mfd. 660 VAC	Commutating Capacitor	24-379	C. D. KG 6070
C18	Capacitor 4 mfd. 45 VDC	Filter Capacitor	24-418	C. D. BR445
C20	Capacitor 1 mfd. 400 VDC	Grid Control Capacitor	24-166	C. D. PJ4W1
C21	Capacitor 2 mfd. 450VDC	Grid Capacitor	24-432	C. D. BR245
C22	Capacitor 0.5 mfd. 600 VDC	Filter Capacitor	24-137	C. D. PJ6P5
C23	Capacitor 8 mfd. 450 VDC	Grid Control Capacitor	24-436	C. D. BR10368-1
C24	Capacitor 2X80 mfd 360 VDC	Filter Capacitor	24-437	C. D. UPT 8835
C26	Capacitor 0.1 mfd. 400 VDC	Tuning Capacitor	24-111	Sprague 67P10404
C27	Capacitor 0.1 mfd. 400 VDC	Blocking Capacitor	24-111	Sprague 67P10404
C28	Capacitor 0.1 mfd. 400 VDC	Tuning Capacitor	24-111	Sprague 67P10404
C29	Capacitor 0.1 mfd. 400 VDC	Blocking Capacitor	24-111	Sprague 67P10404
C30	Capacitor .02 mfd. 600 VDC	Tuning Capacitor	24-122	Sprague TM-12
C31	Capacitor .047 mfd. 200VDC	Blocking Capacitor	24-100	Sprague 67P47392
C32	Capacitor 240 mfd. 400 VDC	Blocking Capacitor	24-010	C. D. 5W5T24
C33	Capacitor .002 mfd. 500 VDC	Flip Flop Capacitor	24-005	Sprague MS-22
C34	Capacitor .002 mfd. 500 VDC	Flip Flop Capacitor	24-005	Sprague MS-22
C35	Capacitor 1 mfd. 400 VDC	Blocking Capacitor	24-166	C. D. PJ4W1
C36	Capacitor 0.5 mfd. 400 VDC	Phase Shift Capacitor	24-117	C. D. PJ4P5
C37	Capacitor 0.5 mfd. 400 VDC	Switching Capacitor	24-117	C. D. PJ4P5
C38	Capacitor 1 mfd. 400 VDC	Output Capacitor	24-166	C. D. PJ4W1
C39	Capacitor 1 mfd. 400 VDC	Input Capacitor	24-166	C. D. PJ4W1
C40	Capacitor 1 mfd. 400 VDC	Input Capacitor	24-166	C. D. PJ4W1
C41	Capacitor 0.25 mfd. 1000VDC	Filter Capacitor	24-168	Sprague PX21
C45	Capacitor .02 mfd. 600 VDC	Tuning Capacitor	24-122	Sprague TM-12
C46	Capacitor .05 mfd. 600 VDC	By-Pass	24-139	C. D. PJ655
C48	Capacitor .1 mfd. 600 VDC	Filter Capacitor	24-179	Cornell Dubilier Budroc ST6P1

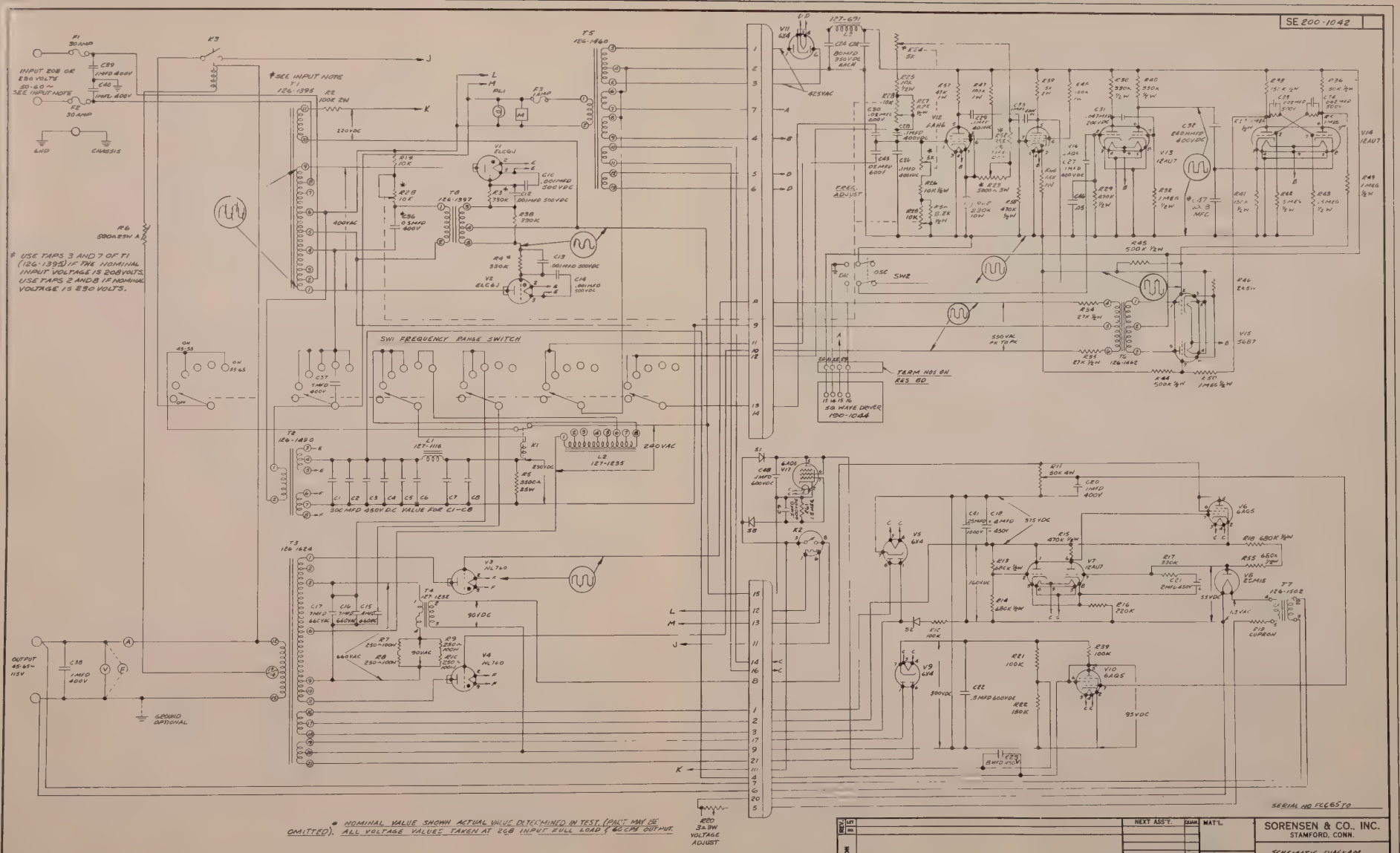
Replacement Parts List

FC1000

Schematic Symbol	Description	Function	Sorensen Part No.	Specifications
T1	Transformer	Input Transformer	126-1395	Sorensen & Co., Inc.
T2	Transformer	Filament Transformer	126-1490	Sorensen & Co., Inc.
T3	Transformer	Output Transformer	126-1624	Sorensen & Co., Inc.
T4	Reactor	Saturable Core Reactor	127-1232	Sorensen & Co., Inc.
T5	Transformer	Power Transformer	126-1460	Sorensen & Co., Inc.
T6	Transformer	Audio Transformer	126-1462	Sorensen & Co., Inc.
T7	Transformer	Diode Transformer	126-1502	Sorensen & Co., Inc.
T8	Transformer	Grid Transformer	126-1397	Sorensen & Co., Inc.
L1	Choke	Filter Choke	127-116	Sorensen & Co., Inc.
L2	Choke	Filter Choke	127-1235	Sorensen & Co., Inc.
L3	Choke	D. C. Choke	127-691	Sorensen & Co., Inc.
K1	Relay	Clatter Relay	190-472	Sorensen & Co., Inc.
K2	Relay	Time Delay Relay	92-118	Amperite 115 NO60T
K3	Circuit Breaker	Over-Voltage	92-251	Heineman 40-608 MG2
V1, V2*	ELC6J Tube	Rectifier Tubes	12-325	Commercial Type
V3, V4*	NL760 Tube	Inverter Tubes	12-324	Commercial Type
V5*	6X4 Tube	Rectifier	12-038	Commercial Type
V6*	6AQ5 Tube	Reactor Tube	12-090	Commercial Type
V7*	12AU7 Tube	DC Amplifier	12-091	Commercial Type
V8	2SM15 Tube	Reference Tube	12-014	Thermosen Co.
V9	6X4 Tube	Rectifier Tube	12-038	Commercial Type
V10	6AQ5 Tube	Grid Control Tube	12-090	Commercial Type
V11	6X4 Tube	Rectifier Tube	12-038	Commercial Type
V12	6AH6 Tube	Oscillator Tube	12-075	Commercial Type
V13	12AU7 Tube	Pulse Shaping	12-091	Commercial Type
V14	12AU7 Tube	Flip Flop Tube	12-091	Commercial Type
V15	5687 Tube	Amplifier Tube	12-091	Commercial Type
V16	6AQ5 Tube	Oscillator Tube	12-090	Commercial Type
V17	6AQ5 Tube	Starting Circuit	12-090	Commercial Type
S1	Rectifier	Start Circuit Rectifier	26-903	Bradley Inc. SE8M 32H
S2	Rectifier	Control Circuit Rectifier	26-900	Bradley Inc. SE8L32H
F1	Fuse	Input Fuse	42-436	Jefferson 391-030
F2	Fuse	Input Fuse	42-436	Jefferson 391-030
F3	Fuse	Transformer Fuse	42-406	Littlefuse 313001


T3
T2
CTRL CKT BD
T5
T4
C16
C17
OSC CKT BD
PRECISION DRIVER UNIT
R6
C2
C15
C1
T1


V4
V3
V2
V1
T8
K1
L1
L2
F1
F2
C2
C8
C3
C4
C7
C5
T1
C6


SE 200-1042
INPUT 208 OR 230 VOLTS 50-60 ~ SEE INPUT NOTE
F1 30 AMP
F2 30 AMP
E3
GND
CHASSIS
C39 1 MFD 400V
C40 .1 MFD 400V
*SEE INPUT NOTE
T1 126-1395
R2 100K 2W
220VDC
400VAC
R6 500Ω 25W
* USE TAPS 3 AND 7 OF T1 (126-1395) IF THE NOMINAL INPUT VOLTAGE IS 208 VOLTS. USE TAPS 2 AND 8 IF NOMINAL VOLTAGE IS 230 VOLTS.
OUTPUT 45-65~ 115V
C38 1 MFD 400V
GROUND OPTIONAL
V1 EL6GJ
R1A 10K
R2A 10K
R3 390K
R3B 330K
C1C .001 MFD 500 VDC
C2 .001 MFD 500 VDC
T8 126-1397
R3A 330K
R3B 330K
C13 .001 MFD 500 VDC
C14 .001 MFD 500 VDC
V2 EL6GJ
SW1 FREQUENCY RANGE SWITCH
ON 45-65
ON 55-65
OFF
C37 1 MFD 400V
T2 126-1400
L1 127-1116
K1
L2 127-1235
240VAC
250VDC
R5 2200Ω 25W
C1 C2 C3 C4 C5 C6 C7 C8
30C MFD 450V DC VALUE FOR C1-C8
T3 126-1624
V3 NL760
C16 C15 7 MFD 660VAC
C17 7 MFD 660VAC
660VAC
T4 127-1232
90VDC
R7 250-100W
R8 250-100W
R9 250-100W
90VAC
V4 NL760
V11 6X4
D1 D2
127-691
C24 C25 80 MFD 350VDC EACH
425VAC
*E24-3E
R25 10K 1/2W
R26 10K
R27 82K 1/2W
C30 .05 MFD 600V
C28 1 MFD 400VDC
C29 .1 MFD 400VDC
R47 1MEG 1W
C23 .1 MFD 400V
R59 5K 2W
R60 100K 1W
R61 330K 1/2W
R62 330K 1/2W
C31 .047 MFD 200 VDC
C32 80 MFD 400 VDC
R49 1 MEG 1/2W
C41 .1 MFD 200V
C42 .05 MFD 600V
C43 .1 MFD 400VDC
C44 .05 MFD 600V
V12 6AN6
V13 12AU7
V14 12AU7
R28 10K
R29 470K 1/2W
R30 470K 1/2W
R31 470K 1/2W
R32 1MEG 1/2W
R33 .47 MEG
R34 15K 1/2W
R35 2.2MEG 1/2W
R36 2.2MEG 1/2W
R37 2.2MEG 1/2W
C33 .05 MFD 600V
C34 .005 MFD 500V
C35 .1 MFD
R38 50K 1/2W
R39 330K 1/2W
R40 330K 1/2W
R41 15K 1/2W
R42 2.2MEG 1/2W
R43 2.2MEG 1/2W
FREQ. ADJUST
OSC SWB
R45 500K 1/2W
R46 2.2K 1/2W
R48 10K
R24 2K 5W
R54 27K 1/2W
R55 27K 1/2W
T6 126-1462
V15 6BB7
R44 500K 1/4W
R50 1 MEG 1/4W
550VAC PK TO PK
TERM NOS ON R83 BD
15 16 17 18
50 WIRE DRIVER 190-1044
S1
C48 1 MFD 600VDC
V17 6X4
S3
K2
R11 50K 4W
C20 1 MFD 400V
V5 6X4
C21 .25 MFD 1000V
C18 4 MFD 450V
375 VDC
V6 6AQ5
R18 680K 1/2W
R15 470K 1/2W
R13 680K 1/2W
R14 680K 1/2W
V7 12AU7
R17 330K
C11 2 MFD 450V
R55 650K 1/2W
V8 12BH8
T7 126-1502
160VAC
55VDC
13VAC
R16 220K
S2
R12 100K
C10 C9 C12 .1 MFD 600V
R10 CUSTOM
V9 6X4
V10 6AQ5
R39 100K
R21 100K
C22 .5 MFD 600VDC
R22 150K
300VDC
95VDC
C19 8 MFD 450V
R20 3Ω 3W VOLTAGE ADJUST
NOMINAL VALUE SHOWN ACTUAL VALUE DETERMINED IN TEST. (PART MAY BE OMITTED). ALL VOLTAGE VALUES TAKEN AT 208 INPUT FULL LOAD & 60 CPS OUTPUT.
SERIAL NO FC665 TO
REVISION
NEXT ASS'Y.
MAT'L
FINISH
SCALE
SORENSEN & CO., INC.
STAMFORD, CONN.
SCHEMATIC DIAGRAM
FC600
DRAWN MM & K APPROV
SE 200-1042

Replacement Parts List

FCD1000

Listed below are all the components used in this instrument, together with their functions and part numbers.

Reference to the schematic diagram furnished with this manual will give the position of each component in the circuitry.

Schematic Symbol	Description	Function	Sorensen Part No.	Specifications
R1	Resistor 100K ohms 2W	Limiting Resistor	27-328	Allen Bradley HB1041
R2	Resistor 10K ohms 10W Adj.	Phase Shift Resistor	27-526	W. L. 10A
R3	Resistor 330K ohms 1W	Grid Limiting Resistor	27-284	Allen Bradley GB3341
R4	Resistor 330K ohms 1W	Grid Limiting Resistor	27-284	Allen Bradley GB3341
R5	Resistor 330 K ohms 1W	Grid Resistor	27-284	Allen Bradley GB 3341
R6	Resistor 500 ohms 10W Adj.	Overvoltage Adj. Res.	27-519	W. L. 10A
R7-10	Resistor 5 ohms 100W	Output Bleeder Resistor	27-827	W. L. 100A
R11	Resistor 27K ohms 1/2W	Grid Limiting Resistor	27-110	Allen Bradley EB2731
R12	Resistor 27K ohms 1/2W	Grid Limiting Resistor	27-110	Allen Bradley EB2731
R13	Resistor 33K ohms 1W	Hold-Off Resistor	27-220	Allen Bradley GB3331
R14	Resistor 1K ohms 2W	Dropping Resistor	27-302	Allen Bradley HB1021
R15	Resistor 1K ohms 2W	Dropping Resistor	27-302	Allen Bradley HB1021
R16	Resistor 1K ohms 2W	Dropping Resistor	27-302	Allen Bradley HB1021
R17	Resistor 47K ohms 1/2W	Voltage Divider Res.	27-945	I. R. C. Boron Carbon
R18	Resistor 22K ohms 1/2W	Voltage Divider Res.	27-944	I. R. C. Boron Carbon
R19*	Pot. 50K ohms 1/3W	Frequency Adj. Pot.	29-211	Chicago Tele.
R20	Resistor 91K ohms 1/2W	Tuning Resistor	27-949	I. R. C. Boron Carbon
R21	Resistor 91K ohms 1/2W	Tuning Resistor	27-949	I. R. C. Boron Carbon
R22	Resistor 91K ohms 1/2W	Tuning Resistor	27-949	I. R. C. Boron Carbon
R23	Resistor 100K ohms 1/2W	Limiting Resistor	27-117	Allen Bradley EB1401
R24	Resistor 100K ohms 1/2W	Limiting Resistor	27-117	Allen Bradley EB1041
R25	Resistor 100K ohms 1/2W	Cathode Resistor	27-285	Allen Bradley GB4711
R26	Potentiometer	Trimmer Pot.	29-060	Clarostat 58-1000
R27	Resistor 1. 5K ohms 1/2W	Trimmer Pot.	27-943	I. R. C. Boron Carbon
R28	Resistor 6. 8K ohms 1W	Reactor Resistor	27-283	Allen Bradley GB6821
R29	Resistor 68K ohms 2W	Reactor Resistor	27-334	Allen Bradley HB6831
R30	Resistor 470K ohms 1/2W	Plate Resistor	27-146	Allen Bradley EB4741
R31	Resistor 680K ohms 1/2W	Plate Resistor	27-950	I. R. C. type DCC

Replacement Parts List

FCD1000

Schematic Symbol	Description	Function	Sorensen Part No.	Specifications
R32*	Potentiometer 3 ohms 3W	Voltage Adj. Resistor	29-032	Clarostat CM10120
R33	Resistor 2.3 ohms/ft.	Range Adj. Resistor	21-005	Driver Harris
R34	Resistor 220K ohms 1W	Cathode Resistor	27-240	Allen Bradley GB2241
R35	Resistor 100K ohms 1W	Limiting Resistor	27-232	Allen Bradley GB1041
R36	Resistor 100K ohms 1W	Bridge Resistor	27-232	Allen Bradley GB1541
R37	Resistor 150K ohms 1W	Bridge Resistor	27-236	Allen Bradley GB1541
R38	Resistor 100K ohms 1W	Bridge Resistor	27-232	Allen Bradley GB1041
R39	Resistor 680K ohms 1/2W	Bias Resistor	27-950	I. R. C. type DCC
R40	Resistor 680K ohms 1/2W	Bias Resistor	27-950	I. R. C. type DCC
R41	Resistor 3500 ohms 25W	Bleeder Resistor	27-720	W. L. 25F
R42	Resistor 470K ohms 1/2W	Tuning Resistor	27-136	Allen Bradley EB4745
C1	Capacitor 1 mfd. 400VDC	Input Capacitor	24-166	Cornell Dubilier PJ4W1
C2	Capacitor 1 mfd. 400 VDC	Input Capacitor	24-166	Cornell Dubilier PJ4W1
C3	Capacitor 0.5 mfd. 600 VDC	Filter Capacitor	24-137	Cornell Dubilier PJ5P5
C4	Capacitor 1 mfd. 400VDC	Phase Shift Capacitor	24-166	Cornell Dubilier PJ4W1
C5	Capacitor 0.5 mfd. 400 VDC	By-Pass Capacitor	24-117	Cornell Dubilier PJ4P5
C6	Capacitor 0.001 mfd. 500VDC	By-Pass Capacitor	24-810	CM30C102K JAN-C-5
C7	Capacitor 0.001 mfd. 500VDC	By-Pass Capacitor	24-810	CM30C102K JAN-C-5
C8	Capacitor 300 mfd. 450 VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C9	Capacitor 300 mfd. 450VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C10	Capacitor 300 mfd. 450VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C11	Capacitor 300 mfd. 450 VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C12	Capacitor 300 mfd. 450VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C13	Capacitor 300 mfd. 450 VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C14	Capacitor 300 mfd. 450 VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C15	Capacitor 300 mfd. 450 VDC	Filter Capacitor	24-427	Cornell Dubilier FW10007
C16	Capacitor 0.001 mfd. 500 VDC	By-Pass Capacitor	24-810	CM30C102K JAN-C-5
C17	Capacitor 0.001 mfd. 500 VDC	By-Pass Capacitor	24-810	CM30C102K JAN-C-5
C18	Capacitor 1 mfd. 400 VDC	Output Capacitor	24-166	Cornell Dubilier PJ4W1
C19	Capacitor 0.75 mfd. 1050 VDC	Commutating Capacitor	24-363	Gudeman
C20	Capacitor 0.75 mfd. 1050 VDC 400	Commutating Capacitor	24-363	Gudeman
C21	Capacitor 100 mfd. 150 VDC	Filter Capacitor	24-144	Sprague Atom TVA-1420

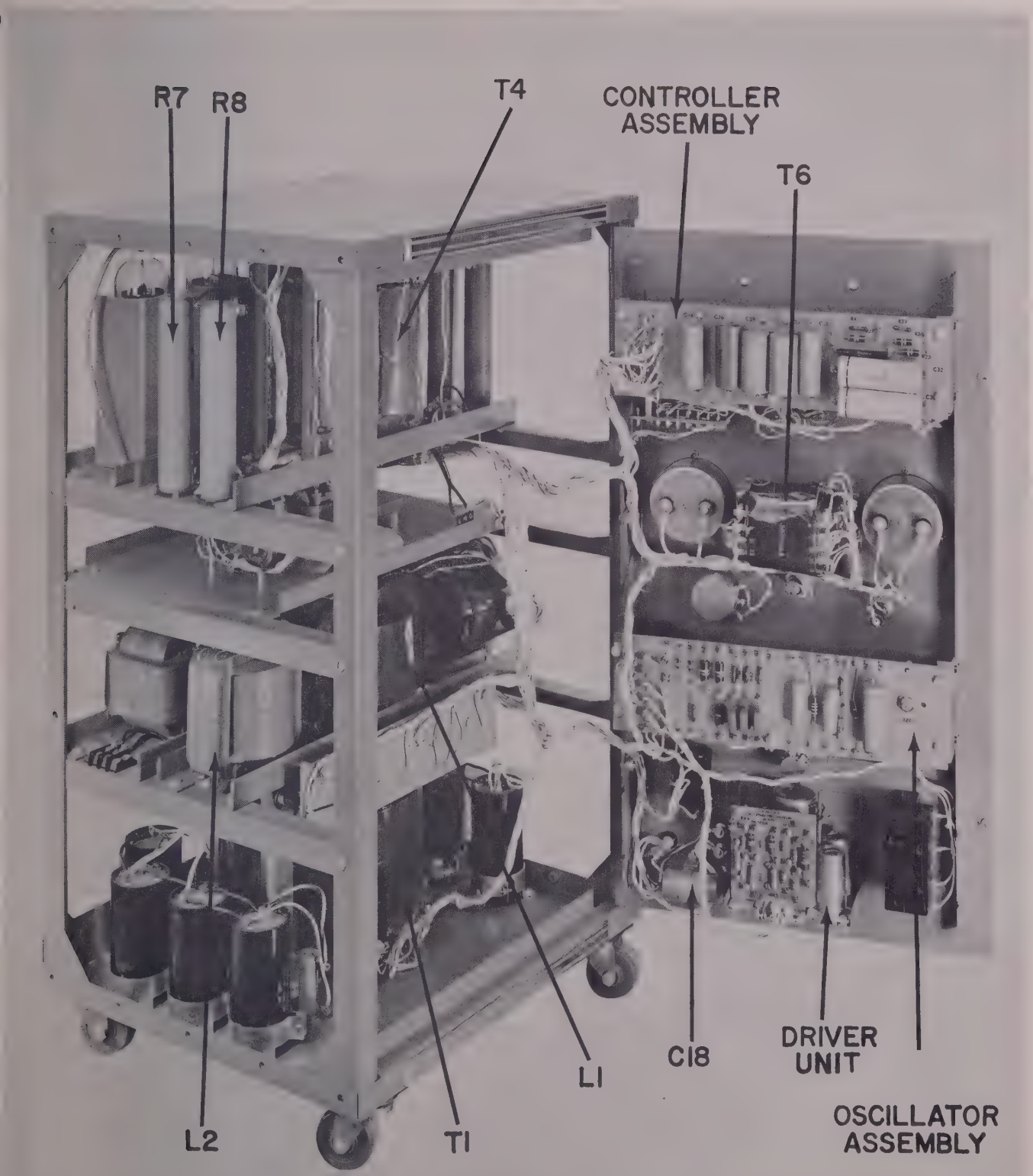
Replacement Parts List

Schematic Symbol	Description	Function	Sorensen Part. No.	Specifications
C22	Capacitor 125 mfd. 350 VDC	Filter Capacitor	24-433	Cornell Dubilier XA012
C23	Capacitor . 0036 mfd. 500 VDC	Tuning Capacitor	24-006	El Menco CM30C362F
C24	Capacitor . 0036 mfd. 500 VDC	Tuning Capacitor	24-006	El Menco CM30C362F
C25	Capacitor . 0036 mfd. 500 VDC	Tuning Capacitor	24-006	El Menco CM30C362F
C26	Capacitor . 05 mfd. 600 VDC	By-Pass Capacitor	24-139	Cornell Dubilier PJ6S5
C27	Capacitor 0. 5 mfd. 400 VDC	By-Pass Capacitor	24-137	Cornell Dubilier PJ4P5
C28	Capacitor 0. 5 mfd. 600 VDC	By-Pass Capacitor	24-139	Cornell Dubilier PJ6S5
C29	Capacitor 0. 5 mfd. 600 VDC	Filter Capacitor	24-137	Cornell Dubilier PJ6P5
C30	Capacitor . 25 mfd. 1000 VDC	Filter Capacitor	24-168	Sprague PX21
C31	Capacitor 0. 5 mfd. 400 VDC	Filter Capacitor	24-117	Cornell Dubilier PJ4P5
C32	Capacitor . 25 mfd. 1000 VDC	Filter Capacitor	24-168	Sprague PX21
C33	Capacitor 0. 5 mfd. 600 VDC	Filter Capacitor	24-137	Cornell Dubilier PJ6P5
C34	Capacitor 1 mfd. 200 VDC	By-Pass Capacitor	24-167	Cornell Dubilier PJ2W1
C36	Capacitor 8 mfd. 450 VDC	Grid Control Capacitor	24-436	D. C. BR-10368-1
C37	Capacitor 0. 001 mfd. 500 VDC	Grid Capacitor	24-810	CM30C102K JAN-C-5
C38	Capacitor 0. 001 mfd. 500 VDC	Grid Capacitor	24-810	CM30C102K JAN-C-5
S1	Selenium Rectifier	Hold-Off Circuit Rect.	26-903	Bradley Lab. Inc. SE8M32H
S2	Selenium Rectifier	Over-Voltage Cir. Rect.	26-907	Sarkes Tarzian Model 100
S3	Selenium Rectifier	Control Circuit Rect.	26-947	Bradley Lab. Inc. SE7L36H438
SW1	Switch DPDT	Input Switch	45-129	AH & H80861
SW2	Switch DPDT	Driver Switch	45-118	Cutler Hammer 837K8
F1-F2	Fuse 30A 250V	Input Fuses	42-436	Jefferson 391-030
F3	Fuse 1A 3AG	Power Trans. Fuse	42-422	Littlefuse 312001
PL1	Pilot Lamp	Power on Indicator	42-301	GE NE51
V	Voltmeter 0-15 OVAC 360-440 cyc.	Output Voltmeter	94-149	Model 432 Burlington 3 1/3 RND.
A	Ammeter 0-15A AC360-440 cyc.	Output Ammeter	94-149	Model 432
M	Motor 115V 60 cycl 35	Fan Motor	91-958	Loyd Scruggs Type 103-1893
F	Frequency Meter 360-440	Output Frequ. Meter	94-315	JBT 33FX
V1, V2*	Tube EL C6J	Rectifier Tubes	12-325	Electrons, Inc.
V3, V4*	Tube NL760	Inverter Tubes	12-324	National Elec.
V5*	Tube 6X4	Rectifier Tube	12-038	Sylvania
V6 *	Tube 0A2	Oscillator Tube	12-069	R. C. A.
V7 *	Tube 6AQ5A	Oscillator Tube	12-090	Sylvania
V8	Tube 6BL7GT	Oscillator Tube	12-070	Tung-Sol

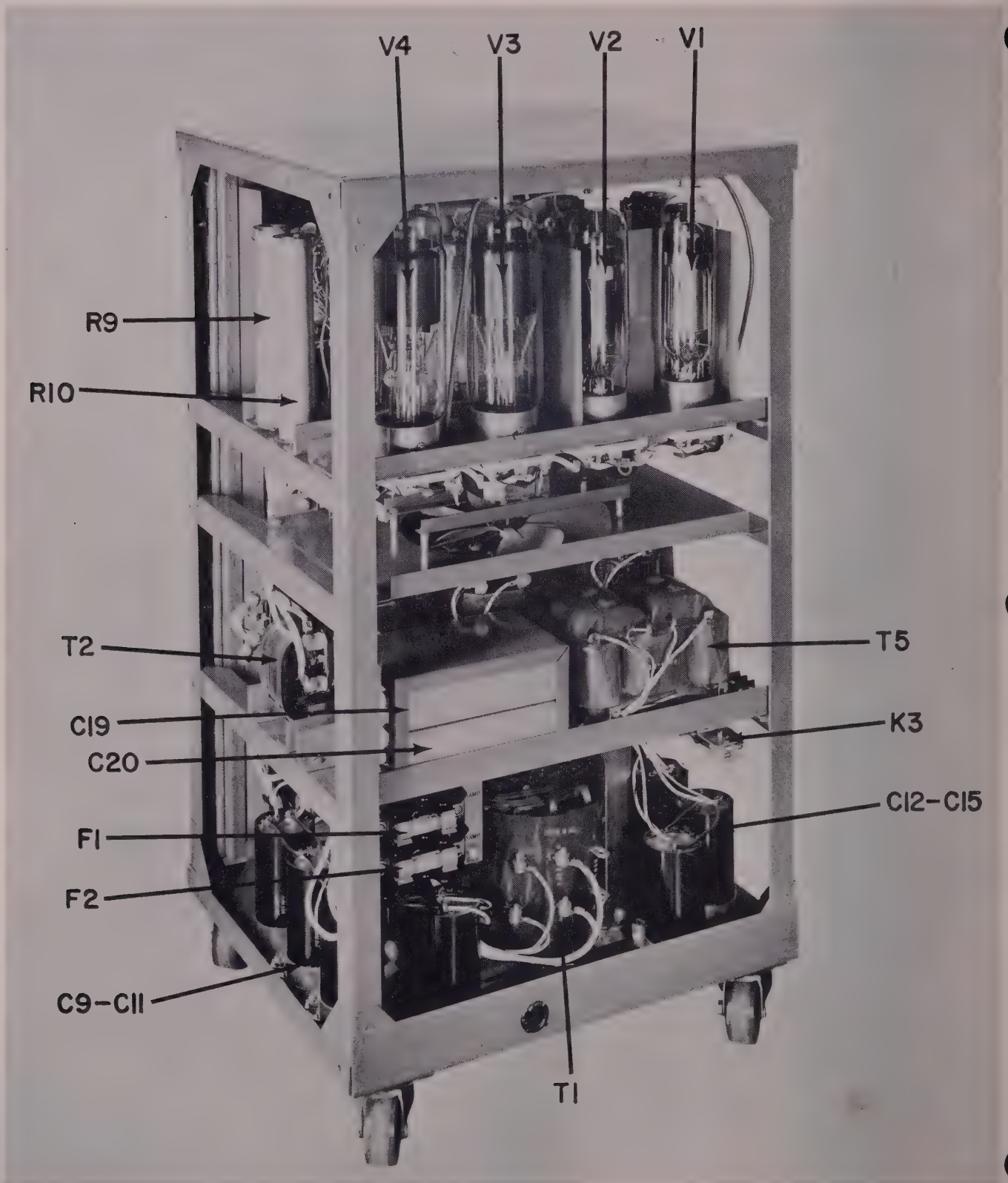
Replacement Parts List

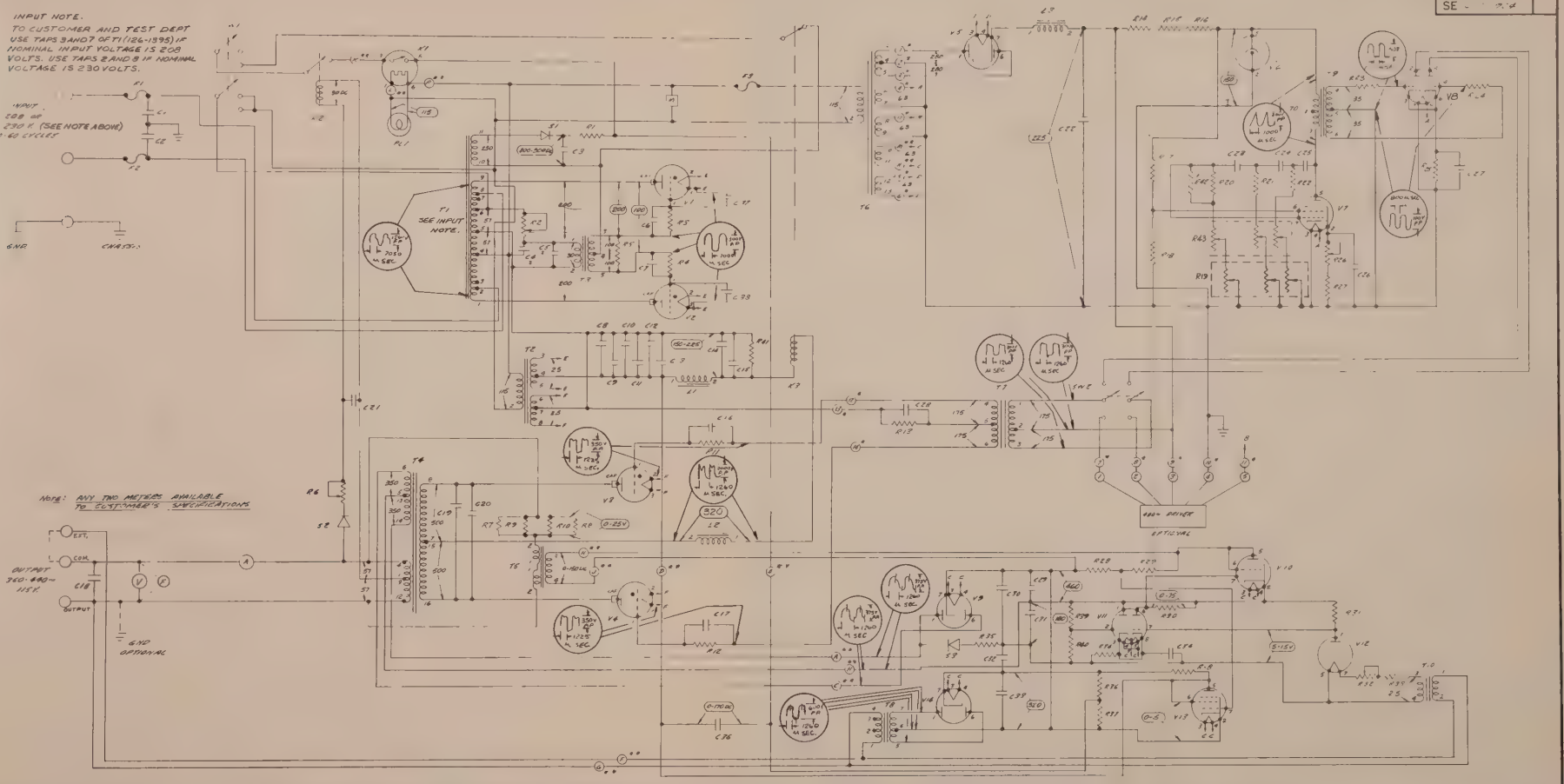
Schematic Symbol	Description	Function	Sorensen Part No.	Specifications
V9	Tube 6X4	Rectifier Tube	12-038	Sylvania
V10	Tube 6AQ5A	Grid ControlTube	12-090	Sylvania
V11	Tube 12AU7A	DC Amplifier	12-091	RCA
V12	Tube2SM1 5	Reference Tube	12-014	Thermosen, Inc.
V13	Tube 6AQ5A	Starting Circuit Tube	12-090	Sylvania
V14	Tube 6X4	Rectifier Tube	12-069	RCA
T1*	Transformer	Input Transformer	126-1395	Sorensen & Co., Inc.
T2	Transformer	Fil. Transformer	126-1396	Sorensen & Co., Inc.
T3	Transformer	Grid Transformer	126-1399	Sorensen & Co., Inc.
T4	Transformer	Output Transformer	126-1399	Sorensen & Co., Inc.
T5	Transformer	Sat. Core Reactor	127-1088	Sorensen & Co., Inc.
T6	Transformer	Power Transformer	126-1398	Sorensen & Co., Inc.
T7, T9	Transformer	Audio Transformer	126-1400	Sorensen & Co., Inc.
T8	Transformer	Plate Transformer	126-1401	Sorensen & Co., Inc.
T10	Transformer	Diode Fil. Transformer	126-1402	Sorensen & Co., Inc.
L1	Choke	Filter Choke	127-1030	Sorensen & Co., Inc.
L2	Choke	Commutating Choke	127-1029	Sorensen & Co., Inc.
L3	Choke	D. C. Choke	127-691	Sorensen & Co., Inc.
K1*	Relay	Relay Time Delay	92-118	Amperite 115 NO 60T
K2	Relay	Relay 32 VDC	92-232	Heineman 40-439
K3	Relay	Relay Leach	190-1086	Sorensen & Co., Inc.

Front View


R7
R8
T4
CONTROLLER ASSEMBLY
T6
L2
T1
L1
C18
DRIVER UNIT
OSCILLATOR ASSEMBLY

Model FCD1000
Rear View




INPUT NOTE.
TO CUSTOMER AND TEST DEPT USE TAPS 9 AND 7 OF T1 (126-1395) IF NOMINAL INPUT VOLTAGE IS 208 VOLTS. USE TAPS 2 AND 9 IF NOMINAL VOLTAGE IS 230 VOLTS.
INPUT 208 OR 230 V. 60 CYCLES
SEE NOTE ABOVE
SEE INPUT NOTE.
NOTE: ANY TWO METERS AVAILABLE TO CUSTOMER'S SPECIFICATIONS
OUTPUT 360-440~ 115 V.
OPTIONAL
400~ DRIVER

ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION	ITEM	DESCRIPTION
R1	RES. 100K 2W	R44	RES. 1K 2W	R89	RES. 68K ½W	R43	POT 50K ½W 3 SECT.	C61	COND. .02 MFD 400 V	C106	COND. .02 MFD 400 V			V10	TUBE 2D21C	T10	PILOT FIL. TRANS. 126-1902	SW1	SWITCH .45-29	A	AMMETER
R2	RES. 2K 10W, ADJ.	R45	RES. 1K 2W	R90	RES. 470K ½W			C62	COND. 100 MFD 450 V	C107	COND. .05 MFD 600 VDC			V11	TUBE 6AQ5			SW2	SWITCH .45-118	F	FREQ. METER
R3	RES. 390Ω 1W	R47	RES. 47K ½W	R91	RES. 680K ½W			C63	COND. 700 MMD. 450 V.	C108	COND. .5 MMD. 400 VDC			V12	TUBE 6A8			SW3	THERM. DPDT ___ 45-118	V	VOLTMETER
R4	RES. 390Ω 1W	R48	POT. 2K 2W	R92	POT. 2K 2W			C64	COND. 700 MFD. 450 V.	C109	COND. .05 MFD 600 VDC										
R5	RES. 390Ω 1W	R49	POT. 50K 3 SECT.	R93	RES. 47Ω / WIRE WD.			C65	COND. 300 MFD. 450 V.	C110	COND. .05 MFD 600 VDC	V1	TUBE 6L6G			L1	FILTER CHOKE 127-1630		
R6	RES. 390Ω 1W	R50	RES. 220K 1W	R94	RES. 220K 1W			C66	COND. 300 MFD. 450 V.	C111	COND. .05 MFD 600 VDC	V2	TUBE 6L6G			L2	FILTER CHOKE 127-1629		
R7	RES. 100Ω 10W, ADJ.	R51	RES. 100K 1W	R95	RES. 100K 1W			C67	COND. .001 MFD 5000 VDC	C112	COND. .05 MFD 600 VDC	V3	TUBE 6L6			T1	INPUT TRANS. 126-1395		
R8	RES. 5 Ω 100W	R52	RES. 68K ½W ±10%	R96	RES. 100K 1W			C68	COND. .001 MFD 5000 VDC	C113	COND. .05 MFD 600 VDC	V4	TUBE 6L6			T2	FIL. TRANS. 126-1398		
R9	RES. 5 Ω 100W	R53	RES. 68K ½W ±10%	R97	RES. 100K 1W			C69	COND. 75 MFD 1250 V 400~	C114	COND. .5 MFD 600 VDC	V5	TUBE 6A8			T3	DRIVE TRANS. 126-1397		
R10	RES. 5 Ω 10W	R54	RES. 100K 1W	R98	RES. 150K 1W			C70	COND. 10 MFD 300 VDC	C115	COND. .5 MFD 600 VDC	V6	TUBE 6A8			T4	OUTPUT TRANS. 126-1399		
R11	RES. 5 Ω 100W	R55	RES. 100K ½W	R99	RES. 100K 1W			C71	COND. 20 MFD 300 VDC	C116	COND. 1 MFD 600 VDC	V7	TUBE 6AQ5			T5	SAT. CLOCK TRANS. (CHOKE)		
R12	RES. 27K 1W	R56	RES. 680Ω 1W	R100	RES. 680Ω ½W			C72	COND. 20 MFD 300 VDC	C117	COND. 100 MFD 150 VDC	V8	TUBE 6AL5			T6	PLATE TRANS. 126-1398		
R13	RES. 27K 1W	R57	POT. 2K 2W	R101	RES. 68K ½W			C73	COND. 300 MFD 450 V.	C118	COND. 175 MMD. 1250 VDC	V9	TUBE 6AL5			T7	HARMO TRANS. 126-1900		
R14	RES. 27K 1W	R58	RES. 150K 1W	R102	RES. 3900Ω 25W			C74	COND. .0036 MFD 500 VDC	C119	COND. .0036 MFD 500 VDC	V10	TUBE 6AQ5			T8	PLATE TRANS. 126-1901		
R15	RES. 1M 2W	R59	RES. 6.8K 1W	R103	RES. 470 Ω ½W			C75	COND. .0056 MFD 500 VDC	C120	COND. .0056 MFD 500 VDC	V11	TUBE 12AU7			T9	AUDIO TRANS. 126-1900		

SERIAL NO. FCA-1311 TO ____

* INDICATES TERM. ON OSCILLATOR TERM. BOARD

** INDICATES TERM. ON CONTROLLER TERM. BOARD.

* NOTE: ELECT. VALUE DETERMINED AT FACTORY. NOMINAL VALUE SHOWN. COMPONENT MAY BE OMITTED.

* * ALTERNATE 26900

REV. LET. NO.	REVISION	DATE	APP'D

NEXT ASS'Y. | USED ON

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS ± 1/64 DECIMALS ± .XX ANGLES ± 1°

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SORENSEN & CO., INC.
STAMFORD, CONN.

SCHEMATIC
RCD-1000

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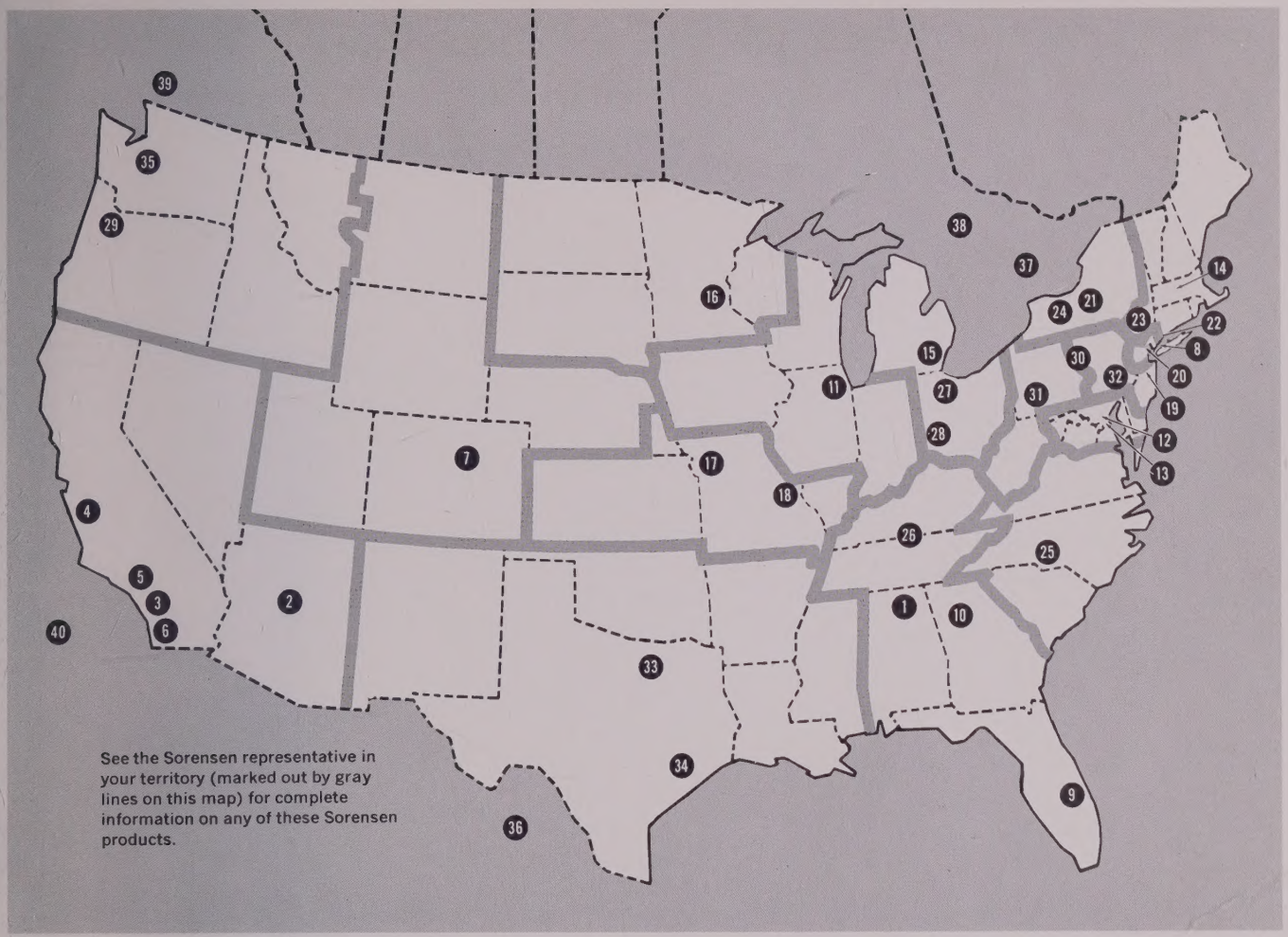
SE 200-906

NOTES

NOTES


See the Sorensen representative in your territory (marked out by gray lines on this map) for complete information on any of these Sorensen products.

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